PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Method of Producing Therapeutically and Disinfectantly Active Substances

We, SYNGALA FABRIC FÜR CHEMISCH-SYNTHETISCHE UND GALENISCHE ARZNEIMITTEL GESELLSCHAFT M.B.H., a Limited Liability Company incorporated under the laws of Austria, of 22, Seebockgasse, Vienna XVI., and Dr. FRITZ FEIGL, an Austrian Citizen, of 38, Wahringerstrasse, Vienna XVIII., Austria, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an improvement in or modification of the invention claimed in Specification No. 12517 of 1936 (Serial No. 474,614) which covers a method of producing gold and silver-containing substances of active therapeutic, disinfectant, and/or sterilising properties, according to which compounds yielding silver ions and gold ions are caused to react conjointly, in an aqueous or other suitable liquid medium in the presence of alkaline substances with compounds of metals which are capable of existing in a plurality of valencies, a compound of a metal in a lower valency, present as a cation, being employed.

The present invention differs from this method in that substances containing metallic gold and silver are produced by a method which does not involve co-deposition of the gold and silver.

It has already been proposed for sterilising and/or disinfecting purposes, to employ metals or metallic compounds, or mixtures thereof, also with the use of carrier substances, thereby as a rule utilising the oligodynamic effect observable in connection with metals.

The present invention provides a method of producing substances of active therapeutic, disinfectant, and/or sterilising properties, and containing highly active metallic gold and silver, together with substances of an oxidising action. The invention further covers a method of uniformly impregnating a large variety of carrier substances with highly active substances containing metallic gold and silver, in a very simple and economical manner.

It is already known to mix gold salt solutions with solutions of metal salts such as manganese, nickel, cobalt and iron salts, with the addition of an alkali to promote reaction and to obtain precipitation.

It has already been proposed to produce therapeutic or disinfectant substances by causing a compound producing silver ions to react with a compound of a metal which is capable of existing in a plurality of valencies, and which is present in a lower valency, in an alkaline medium. In contrast to these known products the substances produced by the present process have an increased activity so that the content of active metals can be reduced whilst the activity remains the same.

According to the present invention a method of producing substances of active therapeutic, disinfectant, and/or sterilising properties, is characterised in that highly active gold-containing substances, which are formed by causing compounds yielding gold ions to react in the presence of an alkaline medium with compounds of metals which are capable of existing in a plurality of valencies, a compound of a metal in a lower valency being employed, are added to or have added thereto highly active oligodynamic substances containing metallic silver.

Suitable alkaline substances for use in the reaction are, for example alkalies, alkali carbonates, and organic bases, as also the oxides, hydroxides, and alkaline salts of the metallic compounds used for the conversion reaction. Examples of suitable metallic compounds are manganous, cobaltous, nickelous, ferrous, and cerous salts on the one hand, and gold salts such as gold chloride, chlorauric acid, and the like on the other hand.

When these substances are reacted in an alkaline medium there result bulky but readily filterable and easily washed precipitates consisting of extremely finely divided gold and the higher valency oxides or hydroxides of the multivalent metals used.

The conversion reaction proceeds for example, according to the following equation:—$2\,Au\,\ldots + 3\,Mn\,\ldots + 12\,OH' = 2\,Au + 3\,MnO_2 + 6\,H_2O$.

Auriferous substances obtained in this way have an eminently activating effect on the properties of highly active oligodynamic substances containing metallic silver, and thus, in addition to many economic advantages, possess very considerable therapeutic advantages over known gold preparations. Thus, for example, when the reaction product from manganous salt, gold chloride, and alkali, is added to highly active oligodynamic substances containing metallic silver, the activity of these latter is increased to a far greater extent than by means of a mixture of manganese dioxide and gold produced in any other manner, substances containing gold and silver produced in accordance with the present invention, and containing gold in a quantity amounting to 10% of the quantity of argentiferous substance present, are of far greater efficacy than products equally rich in silver but lacking the addition of the gold-containing substance.

The precipitation of gold should take place in the absence of compounds capable of forming soluble complex salts with the said metallic compounds capable of existing in a plurality of valencies.

Very special advantages are afforded by a form of the method according to the invention which consists in directly but independently depositing the gold and silver-containing substances on to various kinds of carrier material in the course of the formation of these substances. For this purpose the impregnating of the carriers, for example surgical dressing material, is carried out in such a manner that the carriers are brought in contact with compounds yielding gold ions, and with a compound of a metal which is capable of existing in a plurality of valencies, but which is present in a lower valency as cation, and either previously or thereafter treated with substances of alkaline reaction or solutions thereof. Before or after this treatment the carriers are impregnated with highly active silver-containing substances, which are applied in analogous manner to the gold-containing components.

As carriers there may serve, for instance for the production of antiseptic and even permanently sterile surgical dressing material, fibrous matter of all kinds, such as textile fibres, cotton, and fabrics; further, there can also be employed as carrier material substances such as animal charcoal, silica gels, bole, and other pulverulent substances which are inocuous for the purpose in view and which can also themselves serve as suppliers of hydroxyl ions. This can be effected either by pretreating the carrier with substances of alkaline reaction or by using such substances as are themselves of sufficiently alkaline reaction such as alkaline earth carbonates, oxides such as MgO, ZnO, and others. In all these cases it is sufficient to treat the carriers with a solution of the starting materials and subsequently to wash out any excess of these substances. It is also of course possible to employ as carriers substances (such as animal charcoal) which themselves have therapeutical properties.

In the majority of cases the gold content should only amount to a fraction of the silver content of the product.

In many cases it is advantageous to cause the appropriate substances for forming the gold and silver-containing components to react independently in the presence of protective colloids, for example albuminous bodies, vegetable mucilages, lecithins, and the like. In this manner colloidal solutions or extremely fine suspensions of the reaction products can be produced, which have proved to be effective for example as activators or for the treatment of various infectious diseases such as for instance gonorrhoea.

In applying the method according to the invention for the impregnating of carrier substances the quantity of the gold and higher valency metal oxides, can be accurately predetermined, in a simple manner, merely by suitable proportioning of the alkaline substance used. For example a carrier, such as fibrous material, may be previously impregnated with a measured quantity of alkali. If this fibre material be then reacted for example, with a solution of a mixture containing gold chloride in excess and manganese sulphate there becomes deposited on the fibrous material only that quantity of gold and manganese dioxide which is equivalent to the quantity of alkali used. A predetermined quantity of silver is precipitated in an analogous manner on the carrier before or after the deposition of the gold. The proportions of the individual components, and the order in which they are used, can be varied to suit the purpose for which the product is to be used.

EXAMPLES.

(1) A solution of 8.25 grammes of chloraurie acid and 8.6 grammes of manganese nitrate hydrate in 200 ccs. of water is admixed with caustic soda solution in excess. The resulting precipitate is filtered under suction, repeatedly washed with water, and dried. This precipitate is a black powder of the following composition:—$2.Au.3MnO_2$, in which the gold is present with the quadrivalent manganese oxide in a state of perfectly homogeneous distribution.

The product thus obtained is intimately mixed with a highly active finely powdered substance containing metallic silver, preferably produced by the action of compounds producing silver ions on a compound of a metal capable of existing in a number of valencies and as a compound in a lower valency in an alkaline medium, whilst of the auriferous substance there is used 1/10 of the quantity of the argentiferous substance used.

(2) 75 grammes of gauze is slowly dipped into a solution of 0.83 gramme of chloraurie acid and 0.86 gramme of manganese nitrate in 400 ccs. of water. The expressed gauze is then dipped in a 4% caustic soda solution, and washed out. The gauze is then immersed in a solution of 1.7 grammes of silver nitrate and 1.45 grammes of manganese nitrate hydrate in 500 ccs. of water, expressed, once more bathed in lye, washed and dried.

(3) 200 grammes of gauze is dipped in a solution of 6.4 grammes of silver nitrate and 5.8 grammes of manganese nitrate hydrate in a litre of water. The gauze, after having been squeezed out, is immersed in a 4% NaOH bath, washed, and dried. The gauze is then introduced into a solution of 0.83 gramme of chloraurie acid and 0.86 gramme of manganese nitrate hydrate in a litre of water, expressed, once more immersed in the lye bath, washed, and dried.

(4) There is first prepared a protective colloidal solution, for example by introducing into 500 cm^3 of boiling distilled water, 40 g. of gum acacia or another vegetable adhesive and stirring this mixture until a solution is formed and the solution has cooled. Thereupon the solution thus obtained is diluted to 1400 cm^3 and there are added thereto 16 g. of sodium hydroxide dissolved in 100 cm^3 distilled water. Into this solution there is allowed to flow in small proportions and whilst constantly stirring, a mixture of 32 g. silver nitrate and 27 g. manganese nitrate containing the water of crystallisation ($Mn(NO_3)_2.6H_2O$) dissolved in 300 cm^3. Subsequently there is added to this reaction mixture, in which decomposition has already taken place between silver nitrate, manganese nitrate and lye, a solution of 0.25 g. yellow gold chloride ($HAuCl_4.4H_2O$) and 0.26 g. manganese nitrate dissolved in 100 cm^3 distilled water. The gold chloride and manganese nitrate last added also react with the soda lye still present in slight excess. The now complete colloid solution of the reaction product is diluted to 2100 cm^3 with distilled water and dialysed in an electro-dialysing apparatus or in a parchment tube until the neutral salts resulting from the decomposition are removed. The resulting reaction product constitutes a highly active and very resistant colloid solution.

In connection with the quantities of the separate initial substances referred to in this example there have been used stoichiometric proportions, that is to say the quantity of soda lye added to the protecting colloid solution is such that it is sufficient both for the decomposition of the silver nitrate as also for the decomposition of the gold salt. An excess of soda lye is not disadvantageous as it can be removed easily by the subsequent dialysis. The sequence of the two decompositions described may also be modified, for example the decomposition of the gold salt may be effected first and then that of the silver salt; both may also be carried out in separate solutions which are then mixed together.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of producing substances of active therapeutic, disinfectant, and/or sterilising properties, characterised in that highly active gold-containing substances, which are formed by causing compounds yielding gold ions to react in the presence of an alkaline medium with compounds of metals which are capable of existing in a plurality of valencies, a compound of a metal in a lower valency being employed, are added to or have added thereto highly active oligodynamic substances containing metallic silver.

2. A method according to claim 1, characterised in that as silver-containing substances, there are used substances obtained by the reaction of compounds yielding silver ions with compounds of metal capable of existing in a plurality of valencies, in an alkaline medium, a compound of a metal in a lower valency being used.

3. A method according to claim 2, characterised in that the compounds yielding gold ions and silver ions, are

independently reacted with the further reaction compounds in the presence of carrier substances, there being effected firstly either the precipitation of the gold-containing substances on the carrier substance or the silver-containing substances.

4. A method according to claim 3, characterised by the employment as the said carrier substances of substances which are themselves of sufficiently alkaline reaction, such as for example metal oxides, carbonates and the like or by the impregnation of inert carriers with substances of alkaline reaction.

5. A method according to claim 2, characterised by the fact that the chemical conversion for forming the gold and silver-containing components is caused to proceed in the presence of protection colloids (such as for example albuminous bodies, vegetable mucilage, and the like).

6. The method of producing the gold and silver-containing substances of active therapeutic, disinfectant and/or sterilising properties, substantially as described with reference to the examples given.

7. Gold and silver-containing substances of active therapeutic, disinfectant, and/or sterilising properties, whenever produced by the method according to any of the preceding claims.

Dated this 30th day of April, 1936.

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